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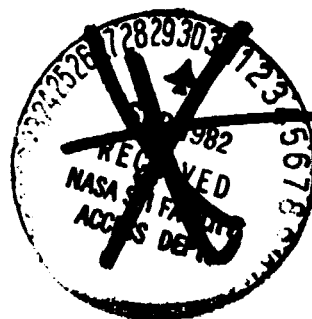
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ENGINEERING-ECONOMIC SYSTEMS DEPARTMENT
STANFORD UNIVERSITY • STANFORD, CALIFORNIA 94305

**PRIVATE FINANCING AND OPERATION OF A
SPACE STATION: INVESTMENT REQUIREMENTS,
RISK, GOVERNMENT SUPPORT, AND OTHER
PRIMARY BUSINESS AND
MANAGEMENT CONSIDERATIONS**

by

Michael Simon
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Engineering-Economic Systems Department
Stanford University Stanford, CA 94305

ABSTRACT

After two decades of performing numerous studies on various space station concepts, the National Aeronautics and Space Administration (NASA) appears likely to achieve an initial "permanent manned presence" in space by the end of this decade. Although the government would play an active role in the development of any space operations base, private investment in a manned space station may represent a viable alternative to complete government sponsorship of such a program. Since private-sector interest in space stations is likely to increase as the public strengthens its commitment to maintaining a manned presence in space, it is desirable that NASA and other government agencies understand the implications of manned space operations from a business perspective. This report outlines the most significant problems which would be faced by a private company involved in a space station enterprise, and suggests possible government roles in helping to overcome these difficulties.

I. Introduction

The expected need for a permanently-manned space station by the end of this decade presents an intriguing opportunity for American industry. The first company or companies to own and operate a space station could be in a position to play a leadership role in all aspects of space industrialization, a high-technology field of emerging importance. A space station could play a pivotal role in the development of space communications and materials processing in space, both of which are expected to become multi-billion dollar industries by the 1990s, and might also have business applications in the areas of life science, space energy and transportation systems, and space defense systems. These activities could represent a combined profit potential of close to \$3 billion annually in space station support services by the end of this century.¹

The barriers to commercial investment in a space station, however, are formidable. Judged by almost any commonly accepted business standard, a space station would be a high-risk venture with potential for large financial losses. Such an endeavor would also raise a wide range of sensitive political and social issues, creating unique problems which would require equally visionary solutions. For a vast majority of free-market players, these barriers are sufficient to discourage any large investment in a manned space station.

For these reasons it is unlikely that a space station could

be built without considerable support from the government. This raises still another important issue: to what extent should the government provide incentives to attract private investment in space projects? While on the one hand space is being touted as the site of an impending "third industrial revolution," it is also true that premature development of space resources by the private sector could have serious adverse consequences. The argument for private investment in space is that it will help to establish an industry which is sensitive to actual market conditions, i.e., the needs of the people. Yet if the government steps in to make such investment possible, the industry which is spawned could be more responsive to the government incentives than to the underlying reasons for the incentives. A period of rapid, artificially stimulated growth could thus be followed by stagnation and continued dependence on government intervention. The railroad and automobile industries are excellent examples of this unfortunate phenomenon.²

This report will not fully answer the question of whether the government should actively stimulate private investment in space. It will, however, take a necessary first step in this direction by defining the barriers to investment, and suggesting steps the government might need to take in order to reduce these obstacles. Before we attempt to decide what the government should do to increase the attractiveness of space investments, we must understand the bases on which such investment opportunities are judged. This will lead to a recognition of those relevant actions the government is capable of taking to encourage such

investments, a requisite understanding for deciding if such actions are warranted.

Investment Considerations

Most business opportunities are judged according to three primary considerations. These are the amount of money invested and recovered, the expected time over which the returns accrue, and the level of risk in the investment.³ Although the primary attraction of the space station is its potential for large economic returns, particularly in the long-term, the investment required would also be tremendous, perhaps as great as for any single privately-financed project in American history. Estimates of the total cost of a space station range from \$2 billion to over \$20 billion, depending on the configuration of the facility and the mode of financing.⁴ Even at the lower end of this range, the financial liability involved in such a venture would be enormous.

On the basis of the second investment parameter, investment horizon (also referred to as "payback period"), the space station investment opportunity is equally suspect. Space operations would probably not begin to generate revenue until five to ten years after the initial investment in the space station, and investment recovery ("break-even") would probably take at least ten to fifteen years. By comparison, most venture capitalists require not only economic recovery, but an extremely high return on their investment, within a period of three to five years.⁵ Expectations of paybacks two or three times the size of the

initial investment within a period of five years or less, are not unheard of in the venture capital industry.

The greatest obstacle to private financing of a space station, however, is risk. There are five major types of risk associated with large investments: technical risk, market risk, financial risk, institutional risk, and business risk.⁶ With regard to four of these five factors (business risk is determined by internal organizational characteristics and will not be considered here, the other four factors will be discussed in greater detail in Section III) a space station enterprise could only be characterized as a high-risk venture. Although there are many actions a company could take to minimize risk (whereas investment level and payback period are relatively fixed requirements), the high levels of perceived and actual risk involved in a space station enterprise are the most critical factors to be dealt with in order to make such a project commercially feasible.

In addition to these "investment-specific" factors, there are other general conditions which could influence the prospects for success in a space station investment. These include primarily economic factors such as inflation and the rate of interest, and also include such less obvious conditions as anti-trust and appropriate regulatory laws, government appropriations for space activities, and national security considerations. The following three sections provide more detailed discussion of all of these factors, as well as recommendations on how the government can act to reduce the dissuasive effect of these factors on private investment in space operations.

II. Space Station - Investment Level and Investment Horizon

The most obvious deterrent to private financing of a space station is the enormous cost which such a project would entail. The multibillion dollar price tag of a space station would exceed the average venture capital investment of one to two million dollars by a factor of several thousand,⁷ and could even rival the \$10 billion cost of the trans-Alaska Pipeline, the most expensive privately-financed project to date. Even if there were very little risk involved in such a venture, financing of a manned space facility by private sources would represent an unusually bold and complex business enterprise, which would require new and innovative government/industry relationships.

It is difficult to pinpoint the minimum investment which would be required to initiate profit-making space operations. Space station cost estimates made by NASA and other government agencies do not necessarily reflect the levels of investment which would be required if such a project were built privately, since the mode of financing has a significant impact on project cost. Recent NASA estimates of space station costs can be useful, however, in developing first-order assessments of investment requirements.

The least expensive design concept under consideration at NASA is the "minimum space station," estimated to cost about \$2 billion. As its name suggests, however, the minimum space station would be a relatively simple and limited facility.

Consisting only of a small three-man habitation module and perhaps one or two other small compartments for science experiments, the minimum space station would have little, if any commercial value. A space station capable of generating sufficient revenue to turn a profit would probably more closely resemble the 8-man "Operational"-phase Space Operations Center (SOC), which Boeing has estimated would cost NASA about \$8.0 billion.⁸ The Operational SOC would include logistics and service modules for space science experiments and materials processing, and facilities for basing at the SOC a fleet of reusable chemical-propulsion orbital transfer vehicles (OTVs). The OTVs would carry payloads from the low-orbit SOC to higher orbits, and might generate substantial revenue by delivering communications satellites to geosynchronous orbits. The SOC-OTVs could also be involved in the potentially lucrative business of satellite-servicing and retrieval. Although satellites become obsolete relatively rapidly, retrieval and reuse of expensive satellite components could be highly cost-effective.⁹

At present these appear to be the most marketable services which a space station could provide. A space station could provide space science services, for which the government would be a primary consumer, with greater capabilities than the Shuttle-Spacelab configuration, and at a lower cost. Space station materials processing capabilities could be attractive to certain private users, such as McDonnell-Douglas Corporation, which anticipates the development of a multi-billion dollar market for space-processed pharmaceutical products by the 1990s.

A fleet of reusable OTVs based at a space station might provide launch services marketable in both the public and private sectors. On the order of five hundred communications satellites may be launched into geosynchronous orbit over the next twenty years, and theoretically nearly all could be placed in their proper orbits via space-based OTVs. The government, in particular the Department of Defense, might also require launch capabilities to geosynchronous orbit which could be provided by a space-based OTV fleet.

With the cost of the Shuttle flights required for deployment of the SOC included, the total investment required for achieving the operational capability just described would be about \$6-10 billion, spread out over a five to ten year period. Clearly the magnitude and timing of this investment limit the range of possible participants in a space station venture. If the Operational SOC were developed privately, the costs and investment horizon could perhaps be reduced significantly by circumventing bureaucratic regulations and inefficiencies frequently associated with large government projects. In such an optimistic case, however, the investment requirements would still be prohibitive by any business standard. Even at \$3 billion, for example, a fully operational space station would still be beyond the means of most private investors, and nearly a hundred times more expensive than the largest venture capital enterprise ever undertaken.¹⁰

Although a fully private undertaking of such a venture cannot be completely ruled out, it is almost certain that the

government would in some sense have to be a "partner" in such an enterprise. In fact, there are numerous incentives which could be provided by the government to reduce space station investment requirements, perhaps to within acceptable ranges. NASA could, for example, develop a space station "core," consisting of habitation modules, solar power arrays, and communications equipment. A private company could then add to the space station core the specific facilities required for doing business in space. A space science module could perhaps be added at a cost of \$500 million to \$1 billion. A commercial materials processing facility might be provided for half as much. Development of an OTV and OTV support equipment could probably be achieved privately for \$1-1.5 billion. A company could therefore provide services on a space station for an investment as small as 5-10% ($\$500\text{M}/\$10\text{B} = 5\%$) of the cost of a full NASA space station. Thus, the cost of developing these service capabilities independently are well within the means of private investors.

Another joint-venture scenario might call for the government to perform the research and development required for a space station, with private companies responsible for production and operation of the station. Contractors could perhaps finance production of some of the required space station hardware with profits earned by designing the components for NASA. In exchange for sponsoring the initial design and development, NASA might require owner-operators of the space station to provide services to the government at a reduced rate. Such an arrangement could reduce space station investment requirements to acceptable levels

because the actual hardware production would comprise only about 30-50% of the total space station cost.¹¹

Joint public-private ventures of this nature would raise a number of new policy problems for the government, but through its Joint-Endeavor and other programs NASA has demonstrated an ability and willingness to work with private companies toward common goals in creative ways. Joint arrangements for space station development could be attractive from the government's viewpoint because they might reduce the appropriations required to establish manned space operations. This would free funds for space station utilization; a major problem with the Space Shuttle is that its high development costs have limited NASA's ability to design uses for it. (The Space Shuttle presently consumes nearly two-thirds of NASA's research and development budget¹²). Moreover, private investment in a space station could be a significant first step toward the establishment of a new, space-based industry with a large tax base and other social benefits. Reducing the investment requirements for space station operations to acceptable business levels might therefore be within the means and in the interests of the U.S. Government.

III. Space Station - Risk

Risk is by far the greatest impediment to private investment in a space station. The high cost of a space station could be considered acceptable for investment purposes if the risks involved in such a venture were sufficiently small. As mentioned earlier, the degree of risk in a space station venture is tremendously high with respect to the four major types of investment risk considered here: technical risk, market risk, financial risk, and institutional risk. It is almost certain that the government's assistance would be needed in order to reduce the risks in a space station enterprise to acceptable business levels.

This dependence on the government, however, would in itself represent a significant risk; as a partner in a long-term space station enterprise the government would be highly suspect. For example, a government delay in providing expected support during space station development, such as NASA's two-year delay in developing the Space Shuttle, could spell disaster for the private partners in such a venture. A change in presidential administrations, or a key NASA personnel change, could also adversely affect the government's ability to follow through on such a long-term commitment. For reasons such as these, any joint private-public venture would need to be backed up by firm agreements, where all parties (including the government) would be legally bound to meet their obligations. Special legislation

might even be required to ensure the availability of government funds for the duration of the project. From the viewpoint of any private partner, the government's involvement in a space station enterprise would paradoxically be necessary for reducing risks, but also a substantial risk in itself. This chapter deals with many of the types of risk which would be involved in a space station venture, and the ways in which the government might need to be involved in order to diminish these risks.

Technical Risk

Technical risk involves all uncertainties with regard to how well a product will function. A space station involving thousands of complex technological components functioning in a hostile and unforgiving environment would entail possibly the greatest technical risk of any private project ever undertaken. Not only would the possibilities for technological, scientific, or human failures be great, but the costs associated with such breakdowns could also be enormous. Particularly in a private space enterprise, the temptation to cut costs and achieve quick results would be great, exacerbating the problem of technical failure.

Through its ongoing research and development programs the government is constantly working to reduce the technical risks which such projects usually entail, and the benefits of this baseline work would almost certainly be available to private organizations involved in a space station enterprise. Beyond this, the government could set up a program within NASA to assist

the private sector in evaluating and overcoming the technical risks involved in early space operations. Such a program could help transfer technical knowledge and expertise from NASA and high-technology industries to a broader cross-section of potential investors, with the specific goal of maximizing the private sector's contribution to (and benefit from) manned space operations. Such a program would probably be most effective in providing potential investors with an initial basic familiarity with space investment opportunities, since investors with limited technical expertise or R&D facilities would probably ultimately contract development work out to better-equipped companies such as aerospace firms.

Market Risk

Whereas technical risk is the risk associated with creation of a product or service (supply), market risk is the risk involved in selling a product (demand). The development of any commodity or service is always preceded by some type of market analysis to define such factors as total product demand, price sensitivities, product distribution, and advertising. The market risk which would be involved in developing space operations is particularly acute because of the possible emergence of competing alternative technologies. During the long lead-time preceeding the operating life of a space station, other means of accomplishing the space station's intended tasks could be developed. NASA's Materials Processing in Space program has demonstrated, for example, that improved ground-based processes

may frequently compete effectively with space processes. This could also happen in other areas critical to the success of a space station, such as space transportation. During the long development time of the Space Shuttle, the European Space Agency developed a strong competitor for commercial launch services: the Ariane expendable launch vehicle. Since materials processing and space transportation could be two of the major services which a space station would provide, these examples are particularly meaningful.

The possible emergence of competing ground-based technologies is only one of many important elements of space station mission modeling and marketing which require extensive further study. Previous studies of space station uses have focused almost exclusively on technological capabilities, without ever addressing the question of who would pay for space station services. This is perhaps because it is exceedingly difficult and risky to forecast demand functions for commodities and services which do not yet exist.

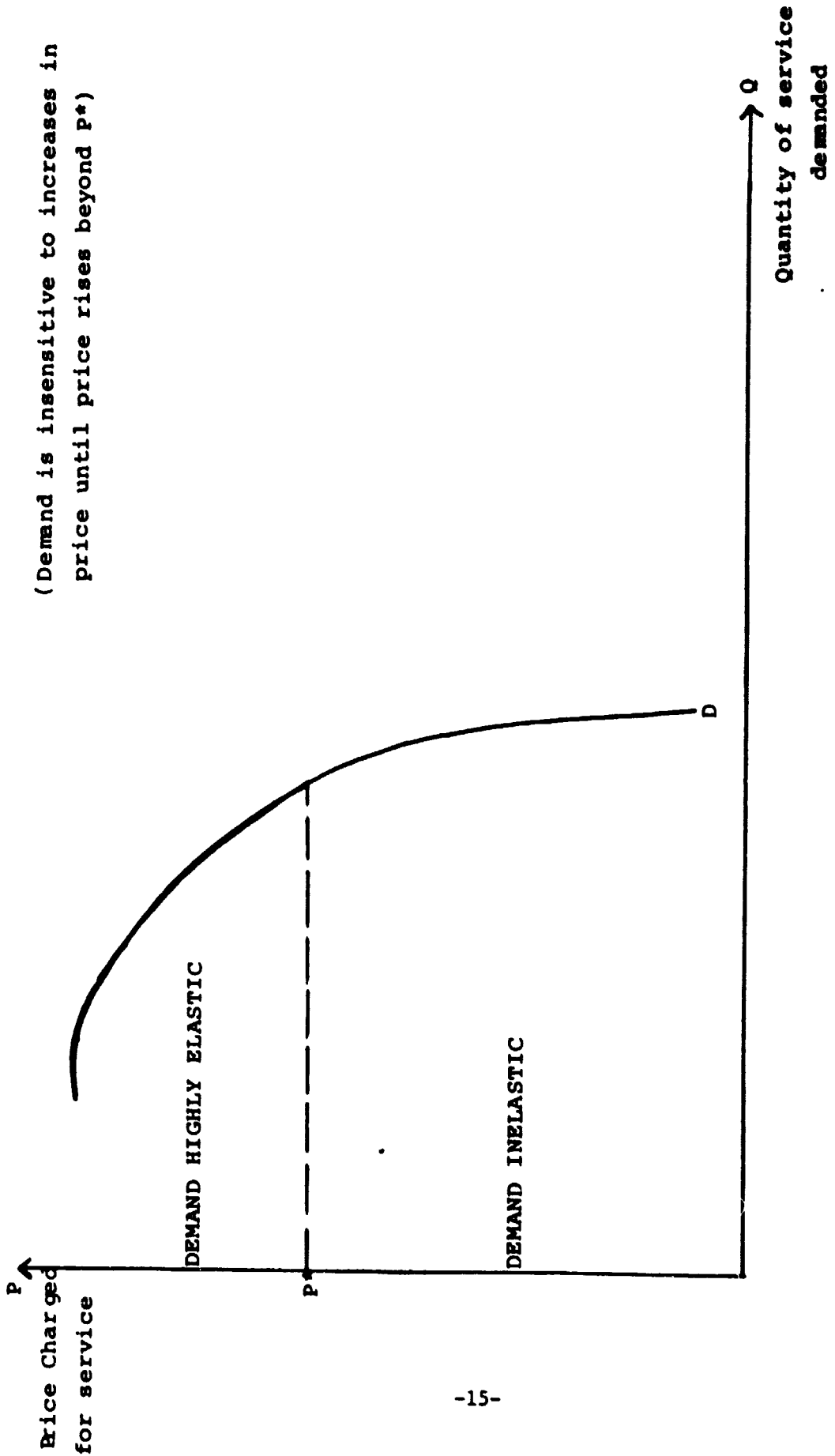
Another type of market risk which should be examined regards the ability of users to pay for space operations. In the absence of competing technologies, the demand for space station services might be fairly inelastic over a certain price range (i.e. not very responsive to changes in price), but at some point demand could suddenly drop dramatically given any additional price increases. The advantage of manufacturing certain high-value products in space, for example, might be so great that relatively large increases in the cost of space processing would not deter

investors from using a space station's processing facility. As the cost of space production increases, however, a point may be reached beyond which Earth-based processes are more economical. (See Figure 1). In the case of such revolutionary services as space operations, it is particularly difficult to determine where such break-points in product demand will occur.

The government might play a key role in reducing market risk by essentially guaranteeing a market for certain space station services. Obviously NASA has a strong interest in utilization of such a facility or the space agency would not be considering the development of a space station as a major new project. Instead of developing a station on its own, NASA could agree to use a private space station for space science services, for example, and promise to pay a certain sum of money to the space station operators annually. Use of a space station for science could possibly save the government several billion dollars over an extended period, so the value of such a market guarantee to the government could be considerable.¹³ Similarly, the government could agree to utilize other space station services, such as OTV flight support for NASA payloads.

Contracting to "rent" the services of a privately-owned space station as needed might be more cost-effective for the government than building and operating the entire space station, and would eliminate a large degree of market risk for the private owners. Although such a market guarantee would raise legal issues concerning government procurement practices and creation of monopoly conditions, there are precedents for such

Figure 1
POSSIBLE DEMAND CURVE FOR A HYPOTHETICAL SPACE STATION SERVICE



government-guaranteed markets, most notably the Terrestrial Data Relay Satellite System (TDRSS). The TDRSS was developed privately and will be leased by NASA for a ten-year period beginning in 1983 for approximately \$2.3 billion.¹⁴

From the perspective of a private space station operator, government use of a space station could present another marketing problem. The government would probably desire priority over other space station users during times of national emergency; the possibility of such a government "priority override" might create problems for commercial users. This is another issue regarding government support and use of privately owned space facilities which requires further study.

Financial Risk

Financial risk, another important element of risk in business ventures, is the uncertainty pertaining to the investment level and payback period. These aspects of a space station venture, which were discussed in the previous section, represent a high degree of perceived risk for such an endeavor, primarily because of the enormous up-front investment which would be required before any profits could be realized. In the case of a space station, financial risk would also include the great ranges of uncertainty regarding development and operating costs, which in such high-technology projects often exceed initial expected by large margins. Financial risk would also be exacerbated by the long lead-time preceeding actual space station operations. In one sense, however, the space station venture

fares favorably with regard to financial risk. The very high long-term potential for financial gain is a primary reason that businessmen may ultimately be willing to face the risks involved in a space station venture.

The government's role in reducing financial risk would probably be limited. Financial risk is a primary "acid-test" for investment opportunities, since it bridges the requirements of investment level and risk management. The government could only influence financial risk by altering the nature of the business task itself, i.e., by sharing the cost of building a space station with the private sector. By developing a space station core, for example, the government might substantially reduce the amount of hardware a company would have to provide, and hence the investment required for initiating marketable space operations.

Institutional Risk

The most critical area of government involvement in a private space station enterprise would be with regard to institutional risk. This is the risk associated with the logistical support services and equipment necessary to carry out a designated task. Institutional risk also encompasses a broad spectrum of uncertainties with regard to the economy, legal rulings, taxes, the availability of government support, and other factors. Institutional risk is in fact the one area in which government cooperation, or at the very least non-interference, is essential to the success of a private space station venture.

As a major example, it would be the government's duty to

ensure the availability of the Space Shuttle flights required for space station deployment, support, and operations, since NASA is the sole operator of the Shuttle. Uncertainties regarding the availability and cost of Shuttle flights are in fact often cited as primary factors in the reluctance of businessmen to become involved in space development. NASA's Joint-Endeavor program, which offers free Shuttle flights and other services to companies which are willing to explore new markets for space products, has to date attracted only three industry participants. A primary reason for this is that in Joint-Endeavor Agreements NASA can only promise to use its "best efforts" to meet the industry participant's Shuttle flight requirements.¹⁵ Maintaining an affordable and reliable fleet of operational Shuttle Orbiters, one of NASA's major agency goals of this decade, will be critical to the management of institutional risk in all types of space endeavors.

Government tax incentives (and disincentives) could also play a great role in determining whether a space station project would represent an acceptable risk to the private sector. Although the government would expect space-based industries to ultimately provide a large tax base, temporary tax incentives during the embryonic years of space development might be a pre-requisite for private investment in such activities. During the development phase, tax credits for research and development expenditures could reduce the investment requirements for such a project considerably. During the early operational stages, tax incentives for operators could reduce financial risk, and tax

breaks for space station users could reduce market risks. These tax incentives could be phased out as the market for space operations develops, and tax revenues from space operations could eventually far exceed the value of the early tax breaks.

Other relevant government actions which would influence institutional risk include anti-trust rulings, environmental and safety regulations, and even international agreements regarding the use of space (although no such agreements have yet been ratified within the U.S.). Department of Defense interests in a private space station are another institutional matter to be considered; the military could become a major customer for space station services, or might alternatively deem private ownership of such a facility a threat to national security. The status of a privately-owned space station vis-a-vis the military would have to be determined at the earliest possible time.

Figure 2

MAJOR ELEMENTS OF RISK IN A SPACE STATION VENTURE

Type of Risk	Manifestation	Possible Government Solutions
TECHNICAL	Uncertainty involved in development and operation of complex space station systems such as space-based Orbital Transfer Vehicles and Materials Processing in Space hardware.	Support ongoing science and technology programs and facilitate transfer of science and technology to private sector through programs such as Technology Transfer.
MARKET	Uncertainty regarding the ability of space station operators to sell their services for a profit.	Guarantee markets for certain services by agreeing to use the space station, and help station operators to track industrial and technological trends.
FINANCIAL	Uncertainty with regard to the investment level, returns, and payback period of a space station venture.	Share space station costs with private sector whenever in the public interest.
INSTITUTIONAL	Uncertainty regarding availability of Shuttle flights; space station tax status; anti-trust, indemnification, and other legal rulings; etc.	Maintain an affordable and reliable Space Shuttle fleet and offer tax incentives to space station financiers, operators, and users whenever possible.

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IV. Space Station - Other Considerations

The attractiveness of a space station venture to the investment community shall be judged over the next several years primarily on the basis of the factors discussed in the previous two sections. Clearly these are but a few of the many important considerations affecting a project of such magnitude and scope. The government will have ample opportunity to influence investor attitudes toward the marketing of space operations, becoming, to a certain extent, a partner in any space station enterprise.

In addition to the investment and risk considerations previously discussed, there will be a number of other factors affecting space station investment decisions over which the government and industry will have little control. One such factor is the rate of interest. When the rate of interest is high, as it is now, long-term projects become unattractive relative to short-term business ventures. The discounted present-value of any income stream rapidly approaches zero, due to the opportunity cost of forgoing other high-yield investments.

Consider, for example, the income streams of two hypothetical investment opportunities (See Figure 3). Option A is a short-term project requiring an investment of \$200 million per year over five years (years 1 through 5), and yielding an income of \$300 million annually over the following five years (years 6 through 10). Option B is a longer-term investment

Figure 3

COMPARISON OF TWO INVESTMENT OPPORTUNITIES (SHORT- AND LONG-TERM) UNDER VARIOUS INTEREST RATES

Interest Rate		Option	Year															Present Value
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
0	A	-200	-200	-200	-200	-200	+300	+300	+300	+300	+300							\$0.5 B
	B	-200	-200	-200	-200	-200	-200	-200	-200	-200	-200	+800	+800	+800	+800	+800		\$2.0 B
5%	A	-190	-181	-173	-165	-157	+224	+213	+203	+193	+184							\$151 M
	B	-190	-181	-173	-165	-157	-149	-142	-135	-129	-123	+468	+445	+424	+404	+385		\$582 M
10%	A	-182	-165	-150	-137	-124	+169	+154	+140	+127	+116							-\$52 M
	B	-182	-165	-150	-137	-124	-113	-103	-93	-85	-77	+280	+255	+232	+211	+192		-\$59 M

opportunity requiring an outlay of \$200 million per year over ten years (years 1 through 10), with a payback of \$800 million per annum during the five years afterward (years 11 through 15). The undiscounted present values of Options A and B are \$0.5 billion and \$2.0 billion respectively, that is, if the interest rate were zero, the value of Option A would be \$0.5 billion, and Option B would be worth \$2.0 billion. With an interest rate of zero, Option B (the long-term investment) would clearly be the better opportunity, with four times the value of Option A.

Consider what happens, however, as the interest rate rises. At an interest rate of 5%, the discounted present value of Option A is \$151 million, and Option B is worth \$582 million. The long-term investment is still superior, although the value of each investment is less than one-third of its undiscounted value. If the interest rate were to rise further to 10%, the present value of each investment would drop below zero, and Option B (present value: -\$59 million) would no longer be superior to Option A (-\$52 million). Similarly, a long-term space station project which appears attractive relative to other investment opportunities when the prevailing interest rates are low might be less attractive, and perhaps highly unprofitable, at higher rates of interest.

The rate of inflation is another factor which would influence the attractiveness of a space station enterprise. By the time a space station becomes operational, its services might be far more expensive to provide than originally anticipated. The cost of a Space Shuttle flight, as an example, will probably

be several times more expensive than was originally expected, due to the combined effects of the general inflation rate and real increases (over the rate of inflation) in the cost of the program. The aggregate impact of the inflation rate and real cost overruns could similarly reduce the profitability and attractiveness of a space station venture.

Any entrepreneurs considering a space station investment would also need to consider their enterprise from a non-business perspective. The social costs and value of such a project would have to be taken into account, especially in light of the government support which would undoubtedly be sought by any investors in such an enterprise. NASA, for example, would probably be more inclined to support an effort to produce life-saving drugs in space than to support a scheme to manufacture "space-jewelry" or other novelty items. In a broader sense, entrepreneurs proposing to "help" NASA to build a space station would almost certainly be asked to demonstrate how their participation in such a project would benefit space station users or the general public.

A space station venture unlikely to generate benefits for society would probably receive little or no support from NASA or other government agencies, and might even run into government or public opposition. Competing efforts from more public-minded private investors might further undermine an endeavor which failed to reflect the public interest. Just as NASA would require insight into the businessman's perspectives on such a project, the private sector would need to be sensitive to NASA's

public mandate in order to work effectively with the government on such a project.

V. Summary

The investment level, risk management, and other considerations outlined in this report provide a lens through which the space station concept can be viewed from a business perspective. Government and industry should work together over the next several years to focus this lens, to determine the most effective private sector role in space station development. The next step in this process is for interested organizations in private industry to evaluate the space station as a business venture, an exercise which would assess the interplay of the factors described in this report, and which would be aimed at ultimately calculating the return on investment, the bottom line in any business plan. Whether or not private industry becomes actively involved in early space station programs, the government should adopt creative and flexible development strategies in order to maximize the opportunities for industry involvement in all phases of space station activities. The government is likely to find that, as its commitment to a manned space station becomes stronger, private-sector interest in space operations will also increase. When industry picks up the initiative, the U.S. Government should be supportive, since every dollar contributed by the private sector represents money potentially saved by the taxpayers, as well as a small step in the direction of space industrialization.

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